6.9.4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

IN REPLY
REFER TO: OEA-095 August 18, 1999

MEMORANDUM

SUBJECT: Bunker Hill, CLP Metals Analysis, Data Validation
Case: 27105
SDG: MJAK27

FROM: Laura Castrilli, Chemist
Quality Assurance and Data Unit, OEA

TO: Mary Kay Voytilla, Regional Project Manager
Office of Environmental Cleanup

CC: Bruce Woods, Region 10 CLP TPO
Jim Stefanoff, CH2M Hill

The following is a validation of ICP-AES and mercury analyses of seventeen total water samples from the Bunker Hill project. The analyses were performed following the USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis Multi-media, Multi-Concentration, ILM04.0. Analyses were conducted by Sentinel, Inc, of Huntsville, Alabama. This validation was conducted for the following samples:

MJAK27	MJAK30	MJAK33	MJAK36	MJAK39	MJAK42
MJAK28	MJAK31	MJAK34	MJAK37	MJAK40	MJAK43
MJAK29	MJAK32	MJAK35	MJAK38	MJAK41	

Data Qualifications

The following comments refer to the Sentinel Laboratory's performance in meeting quality control specifications outlined in the *CLP Statement of Work (CLP-SOW) for Inorganic Analysis, rev. ILM04.0*. The comments presented herein are based on the information provided for the review.

1.0 Timeliness - Acceptable

The technical (40 CFR part 136) holding time from the date of collection for mercury in water is 28 days. The holding time for the remaining metals in water is 180 days. The samples were collected between 06/09/99 and 06/18/99. Mercury analyses were completed on 06/30/99. ICP-AES analyses were completed on 07/11/99.

2.0 Sample Preparation - Acceptable

The samples were prepared for mercury and ICP-AES analyses on 06/29/99.

3.0 Calibrations/Calibration Verifications - Acceptable

The samples were analyzed for mercury by CVAAS on 06/30/99. Initial calibration included one blank and six standards. The curve was linear with a correlation coefficient greater than 0.995.

The samples were analyzed by ICP-AES on 07/03/99 (main analyses), 07/08/99 (lead analyses), 07/09/99 (iron, manganese and/or zinc ten or 100 fold dilutions), and 07/11/99 (thousand fold dilution for zinc). The instrument was standardized according to the analytical method each day of analysis using one blank and a single calibration standard for each element.

All ICP-AES and CVAAS (mercury) calibrations were performed as required and met the acceptance criteria; therefore, no qualification was made on this basis.

Continuing calibration verifications (CCVs) are required before and after sample analysis and after every 10 samples during analysis. Mercury recoveries must be within 80-120%. Other metal recoveries must be within 90-110%. The frequency of analysis of CCVs was met. All ICP-AES and CVAAS (mercury) CCVs (initial and continuing) bracketing reported sample results met the recovery criteria; therefore, no qualification was made on this basis.

4.0 Laboratory Control Samples - Acceptable

Laboratory Control samples are digested and analyzed along with the samples to verify the efficiency of laboratory procedures. All recoveries associated with reported sample results met the acceptance criteria.

5.0 Blanks -

Procedural blanks were prepared with the samples to show potential contamination from the digestion or analytical procedure. If an analyte was found in the associated blank, the sample results were qualified if the analyte concentration was less than five times the analytical value in the blank.

Silver and sodium were detected in the preparation blank. Barium, beryllium, manganese, and zinc were detected in one or more ICP-AES continuing calibration blanks (CCBs). Zinc had negative values with absolute values greater than the detection limit in the preparation blank and several CCBs. Based on blank contamination, associated sample results were qualified as follows:

- barium in samples MJAK35, MJAK39 and MJAK41 was qualified 'U'
- beryllium in sample MJAK27 was qualified 'U'
- silver in samples MJAK27 and MJAK29 was qualified 'U'
- sodium in samples MJAK27, MJAK29 and MJAK35 was qualified 'U'

All other sample results were greater than five times the associated blank levels (or were already undetected) and were not qualified based on blank contamination.

6.0 ICP-AES Interference Check Sample -

The interference check sample (ICS) is analyzed by ICP-AES to verify interelement and background correction factors. Analysis is required at the beginning and end of each sample analysis run and recoveries must be between 80% and 120%. All ICS recoveries associated with reported sample results were within the recovery criterion; with the exception of the zinc recovery (173%R, true value = 33 ug/L) in the second ICS-A analysis on 07/03/99. The ICS-AB recoveries for zinc were all acceptable (true value = 1008 ug/L). No zinc results were qualified based on the ICS-A recovery as all the zinc sample results were at levels greater than the ICS-AB zinc level.

The raw data for a number of samples had interfering levels of iron. Analytes for which iron is an interferent were qualified as follows:

- Antimony in samples MJAK28, MJAK30, MJAK31, MJAK36, and MJAK41 was qualified 'UJ', estimated detection limit (possible false positives due to high iron). Antimony in samples MJAK32 through MJAK34, MJAK39, and MJAK40 was qualified 'J' estimated due to suspected iron interference. Antimony in two of the three ICS-A analyses bracketing these samples had results greater than the detection limit.

- Selenium in samples MJAK28, MJAK31, and MJAK40 was qualified 'J', estimated due to suspected iron interference. Selenium in samples MJAK30, MJAK32 through MJAK34, MJAK36, MJAK39, and MJAK41 are suspected false negatives due to iron interference and were initially going to be qualified 'UJ'. However, due to the extremely low matrix spike recovery for selenium, all undetected selenium results were qualified 'R', unusable. Selenium in the three ICS-A analyses bracketing these samples had negative results with absolute values greater than the detection limit.

- Vanadium in samples MJAK28, MJAK30 through MJAK34, MJAK36, and MJAK39 through MJAK41 was qualified 'UJ', estimated detection limit (possible false negatives due to high iron). Vanadium in two of the three ICS-A analyses bracketing these samples had negative results with absolute values greater than the detection limit.

Some of the samples required one or more dilution runs to report zinc, iron, and manganese results within the instrumental linear range. The

raw data for all analytes were compared using the available dilutions to see if 1) zinc, iron, and/or manganese levels in the undiluted samples were high enough that interelement corrections may not be sufficient for the analytes that were reported from the undiluted

This review was limited to an assessment of just cadmium, iron, manganese, lead, and zinc results. Based on this evaluation, manganese in sample MJAK33 was qualified 'J' estimated (evidence of suppression).

7.0 Duplicate Analysis - Acceptable

Duplicate analyses were done on sample MJAK30. Water duplicate results were within the ±20% Relative Percent Difference (RPD) or ±CRDL criteria for water results < 5 times the CRDL criteria. Laboratory '*' qualifiers were removed from the selenium results as they appear to have been added by mistake. The native selenium result was undetected (instrument detection limit of 3 ug/L, CRDL of 5 ug/L) while the duplicate selenium result was 7.7 ug/L. The IDL plus the CRDL = 8 ug/L so the selenium result was within the CRDL criteria.

8.0 Field Duplicate Analysis - Not Applicable

Field duplicate analysis for samples in this SDG was not indicated in the field collection documentation.

9.0 Matrix Spike Analysis -

Matrix spike sample analyses are done to provide information about the effect of the sample matrix on digestion and measurement methods. Matrix spike recovery must be within the limits of 75 - 125%.

Matrix spike analyses were done on sample MJAK30. All matrix spike recoveries were within the required QC limits, with the exception of antimony (66.5%), barium (67.3%), silver (59%), and selenium (zero percent recovery). All antimony, barium and silver results and all detected selenium results were qualified 'J', estimated (possible low bias for results not qualified due to suspected iron interference or blank contamination). Due to the zero recovery for selenium, all undetected selenium results (most samples) were qualified 'R', unusable.

10.0 Graphite Furnace Atomic Absorption Spec (GFAAS) QC - Not Applicable -

GFAAS was not used for the analysis of these samples.

11.0 ICP-AES Serial Dilution -

Sample MJAK30 was analyzed by ICP-AES serial dilution to check for potential interferences. All analytes which exceeded the minimum concentration criterion (50 times the IDL) agreed within the 10%D

criteria; with the exception of beryllium (37%), cadmium (19%), calcium (19%), cobalt (17%), lead (13%), magnesium (26%), nickel (24%), and sodium (100%). The IDL for beryllium is 0.2 ug/L and the native beryllium result for the serial dilution sample was 10.06 which is 50.3 times the IDL. Since the beryllium result was so close to the minimum concentration criteria, beryllium results were not qualified based on the serial dilution result.

The serial dilution for eight out of twenty-two of the ICP analytes is outside the acceptance criteria. It is suspected that there may be a large interference problem with the sample analyzed for serial dilution. All of the raw data for the samples that required dilution for reporting iron, manganese, and/or zinc were closely examined to see if there was agreement between the native and ten fold or 100 fold dilution analyses. Based on the reviewer's professional judgement, if the ten fold or 100 fold dilution agreed within 10%D with the native analysis, the analyte with the 'poor' serial dilution (five fold dilution) result was not qualified. Analytes with poor serial dilution results and no or poor ten or one hundred fold dilution results were qualified 'J', estimated.

The following analytes were not qualified based on serial dilution results (laboratory 'E' qualifiers were removed by the reviewer):

- Cobalt in sample MJAK31.
- Cadmium and magnesium in sample MJAK36.
- Calcium, cadmium, cobalt, lead, nickel, and magnesium in sample MJAK38.
- Cobalt in sample MJAK39.
- Cobalt and nickel in sample MJAK41.
- Calcium, cobalt, nickel, and magnesium in sample MJAK42.
- Calcium, cadmium, cobalt, and nickel in sample MJAK43.

12.0 Detection Limits - Acceptable

Sample results which fall below the instrument detection limit (IDL) are assigned the value of the instrument detection limit and the 'U' qualifier is attached. Contract Required Detection Limit (CRDL) standards are required to demonstrate a linear calibration curve near the CRDL. CRDL standards were run at the required frequency.

13.0 Overall Assessment of the Data

This validation of the data is based on the criteria outlined in the *National Functional Guidelines for Inorganic Data Review (02/94)*. Approximately 46% of the data was qualified based on blank contamination, interference, matrix spike recovery, or poor serial dilution results. The data as qualified is acceptable for all purposes.

Below are the definitions for the National Functional Guidelines for Inorganic Data Review (02/94) qualifiers used when

validating/qualifying data from Inorganic analysis.

DATA QUALIFIERS

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Analyte may or may not be present.)

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK27

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21195S

Level (low/med): LOW Date Received: 06/10/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	175	B		P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	42.9			P
7440-39-3	Barium	18.0	B	~~N~~ J	P
7440-41-7	Beryllium	0.29	~~B~~	~~E UJ~~ U	P
7440-43-9	Cadmium	27.8		~~E~~ J	P
7440-70-2	Calcium	8060		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	17.1	B	~~E~~ J	P
7440-50-8	Copper	20.2	B		P
7439-89-6	Iron	25800			P
7439-92-1	Lead	936		~~E~~ J	P
7439-95-4	Magnesium	5170		~~E~~ J	P
7439-96-5	Manganese	6830			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	17.4	B	~~E~~ J	P
7440-09-7	Potassium	1550	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	1.4	~~B~~	~~N~~ UJ	P
7440-23-5	Sodium	492	~~B~~	~~E~~ UJ	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	13900			P
	Cyanide				NR

08/18/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK28

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21196S

Level (low/med): LOW Date Received: 06/10/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	14600			P
7440-36-0	Antimony	5.3	B	~~N~~ UJ	P
7440-38-2	Arsenic	710			P
7440-39-3	Barium	9.5	B	~~N~~ J	P
7440-41-7	Beryllium	5.9		~~E~~	P
7440-43-9	Cadmium	1180		~~E~~ J	P
7440-70-2	Calcium	28600		~~E~~ J	P
7440-47-3	Chromium	1.9	B		P
7440-48-4	Cobalt	143		~~E~~ J	P
7440-50-8	Copper	339			P
7439-89-6	Iron	663000			P
7439-92-1	Lead	1420		~~E~~ J	P
7439-95-4	Magnesium	60100		~~E~~ J	P
7439-96-5	Manganese	88400			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	129		~~E~~ J	P
7440-09-7	Potassium	721	B		P
7782-49-2	Selenium	5.6		~~N*~~ J	P
7440-22-4	Silver	8.3	B	~~N~~ J	P
7440-23-5	Sodium	5070		~~E~~ J	P
7440-28-0	Thallium	9.7	B		P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	539000			P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK29

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21197S

Level (low/med): LOW Date Received: 06/10/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	882			P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	20.9			P
7440-39-3	Barium	25.4	B	~~N~~ J	P
7440-41-7	Beryllium	0.36	B	~~E~~	P
7440-43-9	Cadmium	56.0		~~E~~ J	P
7440-70-2	Calcium	9740		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	6.9	B	~~E~~ J	P
7440-50-8	Copper	25.8			P
7439-89-6	Iron	13200			P
7439-92-1	Lead	237		~~E~~ J	P
7439-95-4	Magnesium	11100		~~E~~ J	P
7439-96-5	Manganese	7300			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	7.4	B	~~E~~ J	P
7440-09-7	Potassium	866	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*R~~	P
7440-22-4	Silver	1.6	~~B~~	~~N~~ UJ	P
7440-23-5	Sodium	291	~~B~~	~~E~~ UJ	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	18700			P
	Cyanide				NR

08/18/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK30

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21198S

Level (low/med): LOW Date Received: 06/10/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	27100			P
7440-36-0	Antimony	10.0	B	~~N~~ UJ	P
7440-38-2	Arsenic	1290			P
7440-39-3	Barium	8.2	B	~~N~~ J	P
7440-41-7	Beryllium	10.1		~~E~~	P
7440-43-9	Cadmium	2000		EJ	P
7440-70-2	Calcium	41500		EJ	P
7440-47-3	Chromium	4.3	B		P
7440-48-4	Cobalt	248		EJ	P
7440-50-8	Copper	616			P
7439-89-6	Iron	1290000			P
7439-92-1	Lead	1340		EJ	P
7439-95-4	Magnesium	76500		EJ	P
7439-96-5	Manganese	155000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	221		EJ	P
7440-09-7	Potassium	656	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*R~~	P
7440-22-4	Silver	0.70	U	~~N~~ J	P
7440-23-5	Sodium	21600		EJ	P
7440-28-0	Thallium	20.4			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	1020000			P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK31

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21199S

Level (low/med): LOW Date Received: 06/10/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	27600			P
7440-36-0	Antimony	15.0	B	~~N~~ UJ	P
7440-38-2	Arsenic	1330			P
7440-39-3	Barium	8.3	B	~~N~~ J	P
7440-41-7	Beryllium	10.5		~~E~~	P
7440-43-9	Cadmium	2080		~~E~~ J	P
7440-70-2	Calcium	43600		E J	P
7440-47-3	Chromium	5.9	B		P
7440-48-4	Cobalt	258		~~E~~	P
7440-50-8	Copper	626			P
7439-89-6	Iron	1310000			P
7439-92-1	Lead	1390		~~E~~ J	P
7439-95-4	Magnesium	79200		~~E~~ J	P
7439-96-5	Manganese	157000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	229		~~E~~ J	P
7440-09-7	Potassium	694	B		P
7782-49-2	Selenium	4.5	B	~~N*~~ J	P
7440-22-4	Silver	10.3		~~N~~ J	P
7440-23-5	Sodium	22900		~~E~~ J	P
7440-28-0	Thallium	24.4			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	1040000			P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK32

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21695S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	27600			P
7440-36-0	Antimony	15.5	B	~~N~~ J	P
7440-38-2	Arsenic	1200			P
7440-39-3	Barium	11.2	B	~~N~~ J	P
7440-41-7	Beryllium	5.8		~~E~~	P
7440-43-9	Cadmium	1600		~~E~~ J	P
7440-70-2	Calcium	60000		~~E~~ J	P
7440-47-3	Chromium	1.3	B		P
7440-48-4	Cobalt	505		~~E~~ J	P
7440-50-8	Copper	2160			P
7439-89-6	Iron	665000			P
7439-92-1	Lead	406		~~E~~ J	P
7439-95-4	Magnesium	95000		~~E~~ J	P
7439-96-5	Manganese	115000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	406		~~E~~ J	P
7440-09-7	Potassium	1080	B		P
7782-49-2	Selenium	~~3.0~~	U	~~N*~~ R	P
7440-22-4	Silver	9.4	B	~~N~~ J	P
7440-23-5	Sodium	11700		~~E~~ J	P
7440-28-0	Thallium	11.8			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	738000			P
	Cyanide				NR

06/18/99

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Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK33

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21696S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	217000			P
7440-36-0	Antimony	127		~~N~~ J	P
7440-38-2	Arsenic	12600			P
7440-39-3	Barium	12.7	B	~~N~~ J	P
7440-41-7	Beryllium	28.5		~~E~~	P
7440-43-9	Cadmium	9120		~~E~~ J	P
7440-70-2	Calcium	149000		~~E~~ J	P
7440-47-3	Chromium	17.4			P
7440-48-4	Cobalt	2910		~~E~~ J	P
7440-50-8	Copper	14700			P
7439-89-6	Iron	8260000			P
7439-92-1	Lead	221		~~E~~ J	P
7439-95-4	Magnesium	216000		~~E~~ J	P
7439-96-5	Manganese	34700		J	P
7439-97-6	Mercury	0.13	B		CV
7440-02-0	Nickel	2140		~~E~~ J	P
7440-09-7	Potassium	164	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	0.70	U	~~N~~ J	P
7440-23-5	Sodium	238000		~~E~~ J	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	11400000			P
	Cyanide				NR

6/28/1999

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK34

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21697S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	80900			P
7440-36-0	Antimony	49.0	B	~~N~~ J	P
7440-38-2	Arsenic	2980			P
7440-39-3	Barium	7.5	B	~~N~~ J	P
7440-41-7	Beryllium	13.7		~~E~~	P
7440-43-9	Cadmium	3490		~~E~~ J	P
7440-70-2	Calcium	57000		~~E~~ J	P
7440-47-3	Chromium	12.3			P
7440-48-4	Cobalt	1110		~~E~~ J	P
7440-50-8	Copper	6210			P
7439-89-6	Iron	2070000			P
7439-92-1	Lead	936		~~E~~ J	P
7439-95-4	Magnesium	142000		~~E~~ J	P
7439-96-5	Manganese	301000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	789		~~E~~ J	P
7440-09-7	Potassium	751	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*R~~	P
7440-22-4	Silver	0.70	U	~~N~~ J	P
7440-23-5	Sodium	52100		~~E~~ J	P
7440-28-0	Thallium	52.1			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	1930000			P
	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK35

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21698S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1160			P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	40.8			P
7440-39-3	Barium	5.7	~~B~~	~~N~~ UJ	P
7440-41-7	Beryllium	0.61	B	~~E~~	P
7440-43-9	Cadmium	7.0		~~E~~ J	P
7440-70-2	Calcium	4150	B	~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	11.6	B	~~E~~ J	P
7440-50-8	Copper	12.1	B		P
7439-89-6	Iron	21800			P
7439-92-1	Lead	39.7		~~E~~ J	P
7439-95-4	Magnesium	2180	B	~~E~~ J	P
7439-96-5	Manganese	2500			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	8.9	B	~~E~~ J	P
7440-09-7	Potassium	823	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*R~~	P
7440-22-4	Silver	0.70	U	~~N~~ J	P
7440-23-5	Sodium	599	~~B~~	~~E~~ UJ	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	2940			P
	Cyanide				NR

8/10/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

10

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK36

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21699S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8800			P
7440-36-0	Antimony	3.8	B	~~N~~ UJ	P
7440-38-2	Arsenic	339			P
7440-39-3	Barium	25.6	B	~~N~~ J	P
7440-41-7	Beryllium	1.7	B	~~E~~	P
7440-43-9	Cadmium	514		~~E~~	P
7440-70-2	Calcium	107000		~~E~~ J	P
7440-47-3	Chromium	1.2	B		P
7440-48-4	Cobalt	200		~~E~~ J	P
7440-50-8	Copper	653			P
7439-89-6	Iron	182000			P
7439-92-1	Lead	605		~~E~~ J	P
7439-95-4	Magnesium	119000		~~E~~	P
7439-96-5	Manganese	103000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	175		~~E~~ J	P
7440-09-7	Potassium	3280	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	18.4		~~N~~ J	P
7440-23-5	Sodium	104	U	~~E~~ J	P
7440-28-0	Thallium	6.1	B		P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	228000			P
	Cyanide				NR

6/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK37

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21700S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	108	B		P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	4.2	U		P
7440-39-3	Barium	99.4	B	~~N~~ J	P
7440-41-7	Beryllium	0.24	B	~~E~~	P
7440-43-9	Cadmium	23.4		~~E~~ J	P
7440-70-2	Calcium	21900		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	16.6	B	~~E~~ J	P
7440-50-8	Copper	13.2	B		P
7439-89-6	Iron	2730			P
7439-92-1	Lead	1150		~~E~~ J	P
7439-95-4	Magnesium	50800		~~E~~ J	P
7439-96-5	Manganese	14500			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	21.6	B	~~E~~ J	P
7440-09-7	Potassium	1420	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	4.0	B	~~N~~ J	P
7440-23-5	Sodium	1260	B	~~E~~ J	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	4250			P
	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK38

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21701S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1990			P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	19.9			P
7440-39-3	Barium	19.9	B	~~N~~ J	P
7440-41-7	Beryllium	1.3	B	~~E~~	P
7440-43-9	Cadmium	180		~~E~~	P
7440-70-2	Calcium	14400		~~E~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	25.4	B	~~E~~	P
7440-50-8	Copper	49.7			P
7439-89-6	Iron	54700			P
7439-92-1	Lead	593		~~E~~	P
7439-95-4	Magnesium	24000		~~E~~	P
7439-96-5	Manganese	22200			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	25.4	B	~~E~~	P
7440-09-7	Potassium	891	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	6.0	B	~~N~~ J	P
7440-23-5	Sodium	104	U	~~E~~ J	P
7440-28-0	Thallium	5.6	U		P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	76600			P
	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK39

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21702S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	42600			P
7440-36-0	Antimony	23.9	B	~~N~~ J	P
7440-38-2	Arsenic	2030			P
7440-39-3	Barium	3.9	~~B~~	~~N~~ UJ	P
7440-41-7	Beryllium	8.5		~~E~~	P
7440-43-9	Cadmium	2940		~~E~~ J	P
7440-70-2	Calcium	133000		~~E~~ J	P
7440-47-3	Chromium	1.9	B		P
7440-48-4	Cobalt	945		~~E~~	P
7440-50-8	Copper	4210			P
7439-89-6	Iron	956000			P
7439-92-1	Lead	594		~~E~~ J	P
7439-95-4	Magnesium	116000		E J	P
7439-96-5	Manganese	134000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	804		E J	P
7440-09-7	Potassium	578	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*~~ R	P
7440-22-4	Silver	10.0	B	~~N~~ J	P
7440-23-5	Sodium	26500		~~E~~ J	P
7440-28-0	Thallium	18.0			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	1150000			P
	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK40

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21703S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	25800			P
7440-36-0	Antimony	13.2	B	N J	P
7440-38-2	Arsenic	1140			P
7440-39-3	Barium	10.1	B	N J	P
7440-41-7	Beryllium	5.8		E	P
7440-43-9	Cadmium	1550		E J	P
7440-70-2	Calcium	58800		E J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	490		E J	P
7440-50-8	Copper	2000			P
7439-89-6	Iron	651000			P
7439-92-1	Lead	376		E J	P
7439-95-4	Magnesium	91000		E J	P
7439-96-5	Manganese	111000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	391		E J	P
7440-09-7	Potassium	985	B		P
7782-49-2	Selenium	5.7		N* J	P
7440-22-4	Silver	11.7		N J	P
7440-23-5	Sodium	9920		E J	P
7440-28-0	Thallium	11.7			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	726000			P
	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK41

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21704S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	38700			P
7440-36-0	Antimony	15.8	B	~~N~~ UJ	P
7440-38-2	Arsenic	1980			P
7440-39-3	Barium	2.6	B	~~N~~ UJ	P
7440-41-7	Beryllium	7.0		~~E~~	P
7440-43-9	Cadmium	1720		~~E~~ J	P
7440-70-2	Calcium	42500		~~E~~ J	P
7440-47-3	Chromium	4.0	B		P
7440-48-4	Cobalt	626		~~E~~	P
7440-50-8	Copper	4290			P
7439-89-6	Iron	873000			P
7439-92-1	Lead	336		~~E~~ J	P
7439-95-4	Magnesium	71000		~~E~~ J	P
7439-96-5	Manganese	126000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	469		~~E~~	P
7440-09-7	Potassium	155	B		P
7782-49-2	Selenium	~~3.0~~	~~U~~	~~N*R~~	P
7440-22-4	Silver	7.0	B	~~N~~ J	P
7440-23-5	Sodium	8720		~~E~~ J	P
7440-28-0	Thallium	12.6			P
7440-62-2	Vanadium	1.5	U	J	P
7440-66-6	Zinc	629000			P
_____	Cyanide				NR

08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

16

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK42

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21705S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1470			P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	101			P
7440-39-3	Barium	25.9	B	~~N~~ J	P
7440-41-7	Beryllium	0.20	U	~~E~~	P
7440-43-9	Cadmium	60.8		~~E~~ J	P
7440-70-2	Calcium	240000		~~E~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	116		~~E~~	P
7440-50-8	Copper	42.2			P
7439-89-6	Iron	45600			P
7439-92-1	Lead	641		~~E~~ J	P
7439-95-4	Magnesium	210000		~~E~~	P
7439-96-5	Manganese	129000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	120		~~E~~	P
7440-09-7	Potassium	6900			P
7782-49-2	Selenium	8.6		~~N*~~ J	P
7440-22-4	Silver	33.6		~~N~~ J	P
7440-23-5	Sodium	1060	B	~~E~~ J	P
7440-28-0	Thallium	17.9			P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	37600			P
	Cyanide				NR

JC 08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAK43

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 27105 SAS No.: SDG No.: MJAK27

Matrix (soil/water): WATER Lab Sample ID: 21706S

Level (low/med): LOW Date Received: 06/19/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	105	B		P
7440-36-0	Antimony	2.1	U	~~N~~ J	P
7440-38-2	Arsenic	4.2	U		P
7440-39-3	Barium	8.9	B	~~N~~ J	P
7440-41-7	Beryllium	0.20	U	~~E~~	P
7440-43-9	Cadmium	65.6		~~E~~	P
7440-70-2	Calcium	104000		~~E~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	66.8		~~E~~	P
7440-50-8	Copper	26.6			P
7439-89-6	Iron	1570			P
7439-92-1	Lead	886		~~E~~ J	P
7439-95-4	Magnesium	503000		~~E~~ J	P
7439-96-5	Manganese	199000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	93.3		~~E~~	P
7440-09-7	Potassium	2760	B		P
7782-49-2	Selenium	22.2		~~N~~ J	P
7440-22-4	Silver	54.3		~~N~~ J	P
7440-23-5	Sodium	1940	B	~~E~~ J	P
7440-28-0	Thallium	42.7			P
7440-62-2	Vanadium	1.5	U		P
7440-66-6	Zinc	42100			P
	Cyanide				NR

AE 08/18/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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